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MANAGEMENT OF EXPERIMENTS AND DATA AT THE NATIONAL IGNITION FACILITY*

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ABSTRACT

Experiments, or "shots", conducted at the National Ignition Facility (NIF) are discrete events that occur over a very short time frame (tens of nanoseconds) separated by many hours. Each shot is part of a larger campaign of shots to advance scientific understanding in high-energy-density physics. In one campaign, scientists use energy from the 192-beam, 1.8-Megajoule pulsed laser in the NIF system to symmetrically implode a hydrogen-filled target, thereby creating conditions similar to the interior of stars in a demonstration of controlled fusion. Each NIF shot generates gigabytes of data from over 30 diagnostics that measure optical, x-ray, and nuclear phenomena from the imploding target. We have developed systems to manage all aspects of the shot cycle. Other papers will discuss the control of the lasers and targets, while this paper focuses on the setup and management of campaigns and diagnostics. Because of the low duty cycle of shots, and the thousands of adjustments for each shot (target type, composition, shape; laser beams used, their power profiles, pointing; diagnostic systems used, their configuration, calibration, settings) it is imperative that we accurately define all equipment prior to the shot. Following the shot, and capture of the data by the automatic control system, it is equally imperative that we archive, analyze and visualize the results within the required 30 minutes post-shot. Results must be securely archived, approved, web-visible and downloadable in order to facilitate subsequent publication. To-date NIF has successfully fired over 2,500 system shots, as well as thousands of test firings and dry-runs. We will present an overview of the highly-flexible and scalable campaign management systems and tools employed at NIF that control experiment configuration of the facility all the way through presentation of analyzed results.

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